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TechData Sheet

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Naval Facilities Engineering Service Center
Port Hueneme, California 93043-4328

Bio Pile Remediation

INTRODUCTION

Bio pile remediation is an environmental cleanup technology that uses naturally occurring microbes such as bacteria and fungi to destroy organic contaminants in soil. Certain species of bacteria are able to consume organic pollutants as a food source, thus detoxifying the pollutants.

Bio pile remediation is effective in treating soils contaminated with petroleum hydrocarbons such as waste oil, grease, jet fuels, diesel fuels, and crude oil.

Contaminated soil is placed into engineered piles 8 to 12 feet high and approximately 100 feet long on a waterproof liner. See Figure 1. The microbes' "appetite" is enhanced by blowing air through the contaminated soil pile to provide oxygen and adding fertilizer to provide additional solid nutrients.

PURPOSE OF THE BIO PILE REMEDIATION DEMONSTRATION AT PORT HUENEME

Investigation of bio pile remediation is currently being conducted at the Construction Battalion Center (CBC) in Port Hueneme. Optimization of soil pretreatment, design and placement of aeration pipes, water and nutrient delivery, leachate collection, and offgas treatment is being performed.

ADVANTAGES OF BIO PILE REMEDIATION

Bio pile remediation, in general, has several advantages:

- Is a straightforward process and is easy to implement.
- Is a low-cost technology relative to other remedial alternatives (such as incineration).
- Non-volatile contaminants are destroyed, not transferred to another medium.

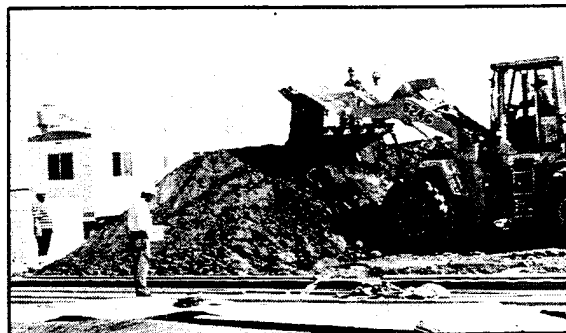


Figure 1

- Is permanent (in that contaminants may be completely degraded to carbon dioxide and water).

Bio pile remediation has the following advantages over naturally aerated processes:

- Speeds up contaminant degradation rates (and thus reduced treatment times).
- Requires smaller land surface area (particularly in contrast with land farming).
- Controls process parameters such as air flow, moisture, nutrients, and temperature better.
- Controls offgases easier, if required.
- Costs less and is easier to collect and recycle the water runoff (leachate).
- Dirt clods that impede air diffusion are less likely to be formed than in tilling the soil.

TECHNICAL DESCRIPTION OF BIO PILE REMEDATION TECHNOLOGY

Remediation uses microorganisms to degrade and/or detoxify contaminants. This degradation results in the breaking down of contaminants into simpler compounds that are less toxic. If the process leaves only carbon dioxide and water as end products, biodegradation is complete, and mineralization is said to have occurred.

Bio pile bioremediation is an *ex situ* version of soil bioventing in which air is pulled or blown through soil to stimulate indigenous hydrocarbon-degrading microorganisms. Throughout the period of remediation, the soil is physically undisturbed while a proper environment is maintained to enhance and maintain acceptable rates of degradation. A schematic of a representative bio pile remediation system is provided in Figure 2.

After the contaminated soil is excavated, it may be pretreated before being placed in the engineered piles. For example, if large rocks or debris are present, they may be removed by screening. In addition, additives such as fertilizer (to provide nitrogen and phosphorous), mulch or sand (to increase porosity), and lime (to raise pH) may be added during the pile construction.

The excavated soil (with rocks and debris removed) is then placed on a prepared bed. The bed is prepared by spreading a 12-inch layer of contaminated soil over a waterproof liner. Perforated pipes are then placed over the soil layer in regularly-spaced intervals. A layer of gravel is usually placed over the pipes, and the excavated and prepared soil is then placed in 8- to 12-foot high piles on the gravel.

The perforated pipe system aerates the soil piles by either blowing air through the pipes into the soil or drawing air from the ambient atmosphere around the pile through the soil. The preferred method is to draw air through the pile. In this way, offgases can be controlled and air flow can be easily monitored. Air drawn from the pile could contain volatile components and may require treatment before discharging it to the atmosphere if permitted levels are exceeded. Activated carbon adsorption is the most common means of treating the offgases.

Moisture content within the pile is maintained with an irrigation system (e.g., drip or soaker hoses). Liquid nutrients can be applied to the top of the pile and allowed to percolate through the pile. Alternatively, solid nutrients (fertilizer) can be mixed with the excavated soil prior to construction of the pile, added to the pile during construction, or scattered over the surface of the completed pile.

A water run off (leachate) collection system is installed. To the maximum extent possible, the leachate will be collected in drums or tanks and recycled to the pile via the irrigation system.

In summary, bio pile remediation technology consists of site preparation, soil pretreatment, design and placement of aeration pipes, an air handling system, water and nutrient delivery, and additional features such as leachate collection and offgas treatment.

For more information about this treatment process, contact Mr. Jeff Heath, Manager, Technology Application Branch, Code ESC414, at (805) 982-1657 or DSN: 551-1657 or call our 24-hour number: (805) 982-4070 or DSN: 551-4070.

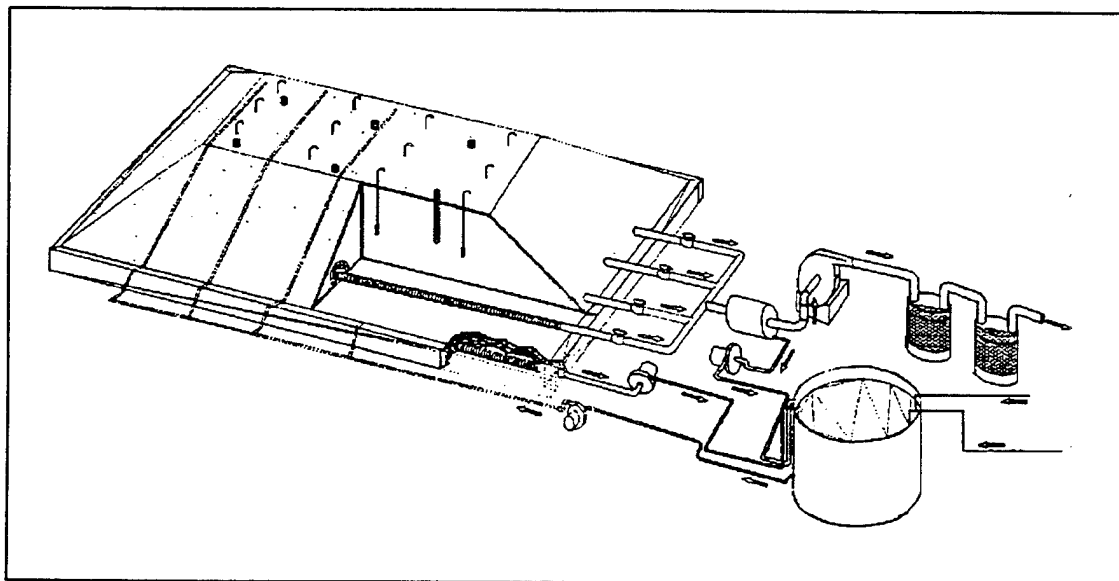


Figure 2. Bio pile remediation system.